

Applying electronic documents in development of the healthcare information system in the Republic of Serbia

Marina Jovanović Milenković¹, Zoran Radojčić¹, Dejan Milenković², and Dragan Vukmirović³

¹ Faculty of Organizational Sciences, Jove Ilića 154,
11000 Belgrade, Serbia
{marinaj, zoran}@fon.rs

² Serbian Armed Forces, Kneza Miloša 33,
11000 Belgrade, Serbia
dejan.milenkovic@vs.rs

³ Statistical Office of the Republic of Serbia, Milana Rakića 5,
11000 Belgrade, Serbia
dvukmirovic@stat.gov.rs

Abstract. During the planning and implementation of Information and Communication Technologies solutions in the healthcare system, attention should be focused on the interests of citizens, healthcare employees, and the public. The project „Development of the Healthcare Information System for Basic Healthcare and Pharmaceutical Services“ demands the implementation of Electronic Healthcare Documentation in the Healthcare Information System of Serbia. This article represents a short overview of previous development of the healthcare information system. Electronic health documentation needs to represent basic health process of every single user. Healthcare Information Systems is based on patients, medical documents, information exchange about patient's health between health's, insurances and financials institutions, with primary goal to made healthy population with less cost.

Keywords: Healthcare system, E-health, Electronic Healthcare Documentation system, patient's health.

1. Introduction

Information and Communication Technologies in the healthcare system have potential, which can be used in order to provide a safer, better, more rational and better-integrated healthcare system, for both the citizens and healthcare employees. These technologies are instruments in achieving strategic goals in the healthcare system, i.e.:

Marina Jovanović Milenković, Zoran Radojčić, Dejan Milenković, and Dragan Vukmirović

- management improvement and development in every element of the system, by making decisions based on evidence provided by healthcare workers, healthcare consumers, intermediaries and politicians,
- creating conditions for sustainable financing of the healthcare system,
- estimation of key dimensions of the healthcare system such as availability, equality, quality, efficiency and sustainability.

During the planning and implementation of Information and Communication Technologies solutions in the healthcare system, attention should be focused on the interests of citizens, healthcare workers, and the public. The basic principles of Information and Communication Technologies are [5]:

- privacy protection of personal and confidential data,
- efficiency and usefulness of the healthcare information system,
- promotion of optimal use of information,
- high quality of healthcare information.

The information system implementation improves efficiency, productivity, and work quality in healthcare institutions, evaluates work, eliminates repetition of data, and enables more comprehensive data use. The Healthcare Information System in hospitals has many functions, such as: scheduling examination appointments for patients, registration of patients, admission and release of patients, medical staff services in specialized out-patient clinics, day-care hospitals and dispensaries, patient's electronic records, diagnostics, laboratory and pharmacy, statistical processing of obtained data, managing support... It also ensures connection with other information systems, Healthcare Insurance Office of the Republic of Serbia (generation of electronic invoice and connection with insurant's database), Central Information Service (database of employees and medical equipment) and the Electronic Healthcare Documentation database.

Institute of Public Health "dr Milan Jovanovic Batut" processes a statistical review of healthcare activities in Serbia. The responsibilities of the healthcare information system are [8]:

- to coordinate the development and realization of different segments of the information system on the national level,
- to organize and carry out statistical researches on the territory of the Republic of Serbia, vouch for the accuracy of processed data, their prompt publication and availability to consumers as well as take necessary measures for data protection,
- to organize and manage activities regarding the methodology of statistical researches and their legislative regulation,
- to organize and manage the education of healthcare workers and their associates in the field of healthcare statistics and informatics, and
- to provide professional assistance to healthcare offices and other healthcare institutions in these fields.

Beside the Institute, the Statistical Office of the Republic of Serbia also processes statistical data as the only institution authorized for official statistics that provides representative data and information on mass economic,

demographic, and social aspects, as well as aspects regarding the working and living environment.

“E-health” describes the use of Information and Communication Technologies in a wide spectrum of healthcare system functions. Innovative and thoughtful applications of this new technology can increase the consistency, reliability, and quality of information delivered [6]. Features and solutions of “e-health” include products, systems and services that go beyond simple internet based applications. Besides features designed for experts and professionals, there are also features designated to include active participation of patients and citizens in their own healthcare. “E-health” is correlated with organizational innovations and development of new skills, and oriented towards patients and citizens and can contribute in providing better and lower cost healthcare services [1]. Journal of Medical Internet Research adds up 10 more „e-characteristics“, “10e’s” of “e-health” to the above definition [2].

“E” in e-health does not stand only for “electronic” but also contains numerous others “10e’s” which together best describe what e-health really is (or what it should be):

- **efficiency** – one of the assurances of e-health is to increase efficiency of healthcare services and thereby reduce the costs,
- **enhancing** quality of care,
- evidence based,
- **empowerment** of consumers and patients,
- **encouragement** of new correlations between patients and healthcare workers,
- **education** of doctors and consumers (patients and citizens) through on-line sources,
- **enabling** standardized information exchange between healthcare institutions,
- **extending** healthcare beyond conventional limits. This refers to geographical and conceptual limits,
- **ethics** – e-health includes new interaction forms between patients and doctors and sets new challenges and solutions regarding ethical matters such as on-line professional medical office, privacy and equity,
- **equity**.

The organization of the paper is as follow. Section 2 includes the development of electronic medical documentation within the health system in Serbia. The third section includes the development of models for data exchange on the patient level as well as generation and dissemination of information through adequate infrastructure. Section 4 shows contribution of the information system and further development perspective. The fifth section gives a critical review of the development of electronic health system. Conclusion of the paper is given in the section six.

2. E-Health in Serbia in a Development

Taking into account the specificities of the health system in Serbia, Figure 1 shows the main components that make up the “building blocks” of e-health [3].

Their scope and contents are organizational aspects of the Serbian healthcare system, not by technological resources. Technology must be used in accordance with present organization, but it also has to be independent and not disturb organizational changes, i.e. has to sustain and support any organizational changes with minimal additional costs.

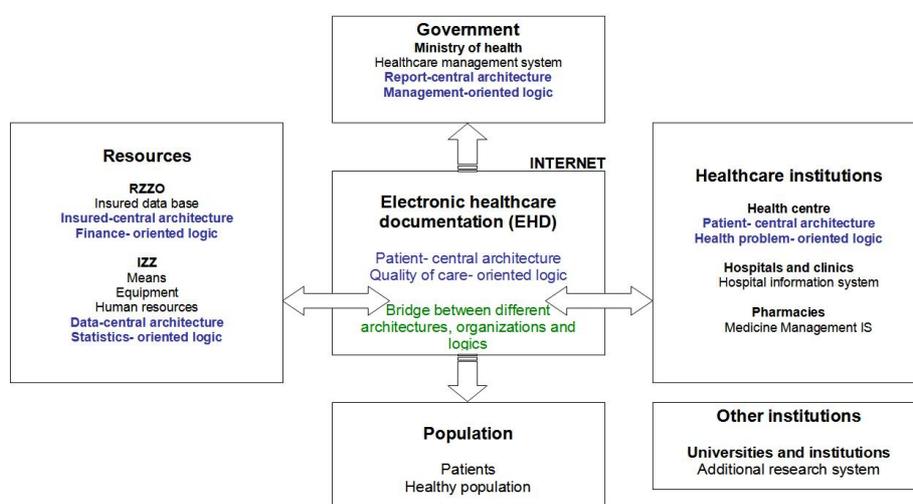


Fig. 1. Electronic Healthcare Documentation (EHD) inside the Healthcare System in Serbia [3]

One of the basic components is the Electronic Healthcare Documentation system (EHD) which is based on electronic healthcare documentation of a particular healthcare consumer unified through a singular identifier throughout the complete healthcare system. EHD system provides data on basic processes in the healthcare system regarding the healthcare of a particular consumer.

Through the EHD system, selected data from various sources (different institutions and locations) are available to all authorized consumers (different institutions and locations). Same data can be available in different ways: patient-centric for doctors, aggregated for statistics, analytically processed for decision makers (managers), multidimensional correlated for researchers, informative for the public etc.

The main role of EHD system is to make space for a new approach to business processes in the healthcare system supported by information and communication technologies. Key characteristics of this new approach are patient-orientation, evidence based medicine, exchange of information

Applying electronic documents in development of the healthcare information system in the Republic of Serbia

regarding patient health in order to improve healthcare services, and decrease costs.

The operational role of EHD system is:

- to set common standards for data exchange,
- to provide minimal data on the treatment of particular patient's health problem,
- to provide minimal data on the health condition of particular patient,
- to build up infrastructure for data managing (collection, storage, distribution),
- to provide a high level of privacy and safety.

Figure 2 shows the system of EHD in frame of global health information system in the meaning of data.

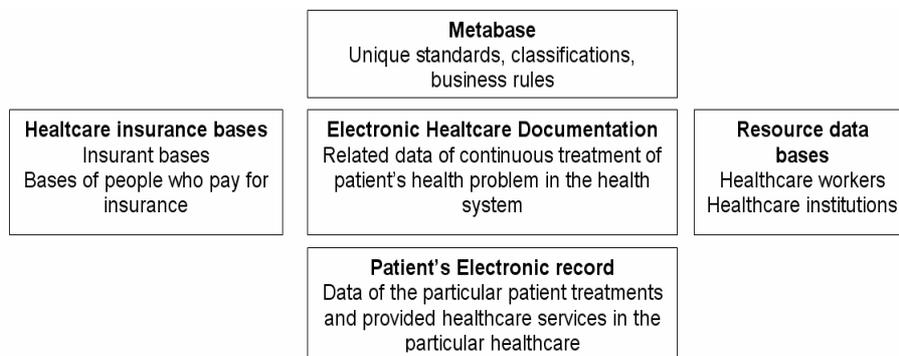


Fig. 2. EHD system, data overview

The concept of connected electronic healthcare documentation must comply with European standards in the e-health area, primarily oriented on improving the health of each individual. Healthcare professionals using modern information and communication technologies provide data for interconnected electronic healthcare documentation. Figure 3 shows the correlation of electronic medical documentation that is available to all users regardless of location. Access to information is strictly controlled using the standards for privacy and security of information, modern technological solutions and legal rules.

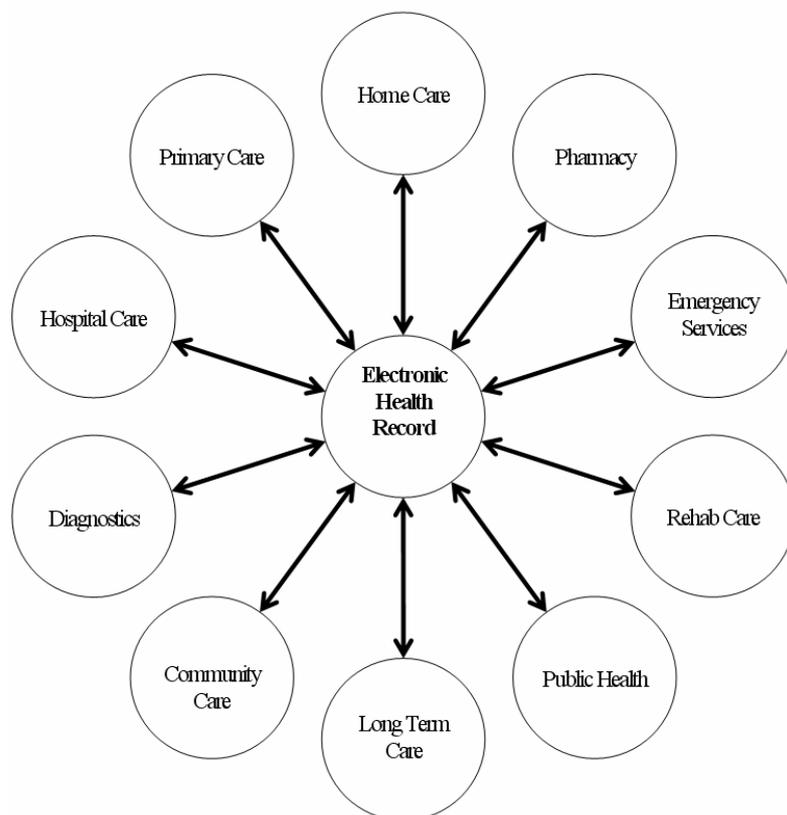


Fig. 3. Connected Electronic Healthcare Documentation [6]

3. Development of the Healthcare Information System in the Republic of Serbia

Generally, healthcare information systems in the region of Southeastern Europe and in Serbia as a part of this region is mainly old-fashioned and in paper form. There is no coordination, also, the information and communication technologies are rarely implemented.

Table 1 shows main participants in the healthcare system, their present roles in the system and improvements to be achieved in the Republic of Serbia [7].

Table 1. Main participants in the healthcare system

Participant	Role in the healthcare system	Informatics role	Improvements to be achieved
Patient	Healthcare consumer	Stores and transfers healthcare documentation from one place to another	Saves time and energy, Gets faster and better service, Reduced margin for errors.
Healthcare employee	Provides healthcare services	Reads, transcribes, and checks particular healthcare documentation. Makes notes of important events prescribed by the law (diagnostics and services)	Saves time in prescribing, Reduces margin for errors, Gets more detailed insight into treatment of his patients done by other doctors, Automatic markup of important information in the background, Information accessibility and continuous education, Organize provision of healthcare services.
Healthcare institution	Provision of healthcare organization and services	Processes particular data, Submits single and aggregated data to health care office and healthcare insurance fund.	Automated processing of particular results, Electronic reporting to health care office and healthcare insurance fund, Realistic picture of situation for managing purposes.
Health insurance fund	Healthcare system financing and planning	Receives and processes data on provided services submitted by healthcare institutions.	Receives more accurate data
Healthcare protection office	Organizing and planning healthcare services	Receives and processes data submitted by healthcare institutions	Receives more accurate data
Ministry of health	Legislation of healthcare services	Interprets reports submitted by health care office and healthcare insurance fund	Make decisions based on more accurate data

Marina Jovanović Milenković, Zoran Radojičić, Dejan Milenković, and Dragan Vukmirović

In August 2002, Ministry of Health of the Republic of Serbia established the International Cooperation and Project Coordination Department. Cooperation with the World Bank and European Union resulted in initiation of several projects. Couple of bilateral projects has been realized with donation support from different countries, European Investment Bank, organizations such as ECHO, UNDP, UNICEF, International Red Cross, EPOS, Global Fund, USAID etc.

Since 2002, foreign partners have contributed in making several documents that served as base for the healthcare system reform and those documents are:

- Policy of Healthcare Protection in Serbia, dated 2002,
- Vision of Healthcare Protection System in Serbia, also from 2002, and
- Strategic Reform of Healthcare System until Year 2015, promoted in the publication “Better Healthcare for Everybody in the Third Millennium” (2004) [7].

The project “Development of the Healthcare Information System for Basic Healthcare and Pharmaceutical Services” started on November 15, 2004. The main goal of this project is the implementation of Electronic Healthcare Documentation (interconnected EHD) into the Serbian Healthcare Information System (EIS).

Strategic goals of the project are:

- to contribute to raising the level of responsibility in the Serbian healthcare system,
- to make easier the transition process towards evidence based healthcare system for the purpose of expenditure control and avoidance of repetition in the process of providing basic healthcare services and drug prescriptions,
- to establish a national healthcare information system based on e-health principles and adequate standards of medical informatics.

Specific operational goals of the project are:

- to develop an electronic healthcare information system, as the essence of national healthcare information system, based on European and other international standards on EHD, localized and adopted on the national level,
- to develop and implement a national center for interconnected EHD in Belgrade and four regional centers for interconnected EHD in Belgrade, Novi Sad, Nis and Kragujevac through the pilot implementation in Pancevo; these centers will ensure data exchange on the patient level as well as generation and dissemination of information through adequate infrastructure,
- to recommend adequate legislative measures necessary for implementation and proper functioning of the system, with an accent on data privacy, protection and safety, in compliance with European legislative regulations,

- to recommend an organizational and institutional frame which will ensure sustainability and enable further expansion of the interconnected EHD system.

Development strategy of the integrated e-health system in Belgrade is in comply with the principles and standards of EU and represents an integral part of the e-health system of the Republic of Serbia. Main goals are to make a comprehensive and integrated e-health system that will enable collection and management of healthcare, clinical, administrative, and financial information in Belgrade, in a technologically adequate way.

Besides Healthcare Center Savski Venac, few other centers have developed the system, such as Healthcare Center Mladenovac, Healthcare Center Zemun, Clinical Center of Serbia, Clinical Center Kraljevo etc. Based on previous experience, there emerges the necessity of reaching a consensus, a widely accepted solution on electronic healthcare record contents and development of technical standards that will make these records easily accessible and safe.

Results of internal researches in Healthcare Center Savski Venac showed that a large amount of effective working hours is being spent on filling in different kinds of forms, daily and monthly reports (about 30% by doctors and even up to 70% of working hours by nurses). According to the new system, right after the check-in moment on the reception desk, patient's data are being forwarded into the doctor's computer and the doctor is able to see the daily list and examination schedule in every moment. The new approach enabled by the information system is not based only on computer use, but there doctor-nurse teams have also been formed according to the latest EU recommendations. For instance, while the doctor is performing medical examination, the nurse enters general data, and while the doctor is prescribing therapy or further specialist examinations, the nurse prepares patient for further examinations. By using the same computer simultaneously, required data are entered only once by one of the team members and on the same location. The stored data are afterwards easily accessible for the statistics and accounting departments and can be easily forwarded to higher instances [8].

This kind of approach reduces waiting time for the patients and improves quality of healthcare services provided.

Implementation of the electronic healthcare record does not change examination duration, but does change the effective period of time that the doctor can dedicate to his patient.

Centralized model of data collection and management is being developed and will enable organized and standardized inflow of information from all organizations, ready for analytical processing at any time. This model does not exclude local storage and processing of data, but enables simultaneous transparent availability, both on the centralized and local level. This is achieved by integration and collection of data in real time through the centralized data repository.

The development of e-health in Belgrade is currently directed mainly towards development of necessary infrastructure, but implementation of

Marina Jovanović Milenković, Zoran Radojčić, Dejan Milenković, and Dragan Vukmirović

certain applications is expected shortly, such as electronic drug prescription, permanent medical summary, electronic record etc. There are initiatives in progress for the acquisition of necessary equipment for institutions, development of local computer networks and connection with dislocated clinics and computer connection between pharmacies and healthcare centers. Intensive efforts are being made in Belgrade Pharmacy to further develop the present network and create conditions for faster drug disburse, and there are several local computer networks realized with funds from National Investment Plan as well as the complete communication infrastructure of Clinical Center "Dragisa Misovic".

Several other projects in different healthcare institutions are being realized in cooperation with EAR, Health Insurance Fund and Ministry of Health.

In order to speed up the development of e-health in Belgrade and Serbia, it is necessary to ensure extraordinary cooperation between all participants in the project, because the essence of the following reforms in the healthcare system is closely connected to informatics systems.

Figure 4 shows the network infrastructure in Serbia, which includes four regional key-points (Novi Sad, Belgrade, Kragujevac, Nis) and the National Key-Point in Belgrade. It should enable the safe exchange of data on the health of patients.

Each of the four regional key-points includes several districts as defined now (there are 25 districts in Serbia without Kosovo). Accordingly, new levels of management in the healthcare system are being defined.

The key-points are connected in a virtual network of the healthcare system through the national network infrastructure. Centers for electronic healthcare documentation are at the key-points of the national network infrastructure of the healthcare system. These centers are equipped with servers (Internet/Web, Application & Database) and a large database management system.

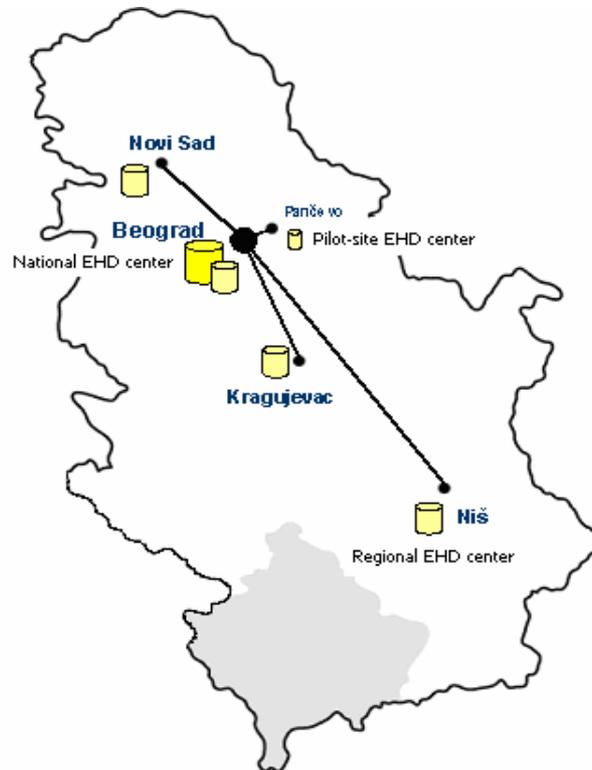


Fig. 4. Infrastructure of EHD system network in Serbia

4. Contribution of the Information System and Further Development Perspective

The interconnected EHD system represents an integral factor for the completely healthcare information system. Implementation of the system should speed up organized and synchronized computerization of healthcare institutions in accordance with standards and accepted rules. Gradual interconnection of a larger number of computerized healthcare institutions with centers of interconnected EHD will increase representativeness, importance and usefulness of data stored in databases of the interconnected EHD and thereby affirms evidence based healthcare.

The interconnected EHD system sets the foundations of the new approach to organization and performance of business processes in the healthcare system supported by information and communication technologies. Main characteristics of this new approach are patient-orientation; evidence based health care, exchange of information regarding patient's health, with the aim of improving healthcare services and decreasing costs.

Marina Jovanović Milenković, Zoran Radojičić, Dejan Milenković, and Dragan Vukmirović

The plan is to connect EHD data from different sources (patient's electronic records from healthcare centers, hospitals and pharmacies), to form a complete „image“ of the patient's health condition and enable such interconnected data to be available to doctors in order to provide quick insight into data important for the medical treatment – allergies, health problems, reactions to certain drugs etc. In addition, the system would enable different ways of data availability – insight into general health condition for doctors, aggregated for statistics, analytically processed for decision makers (managers), multidimensional correlated for researchers etc.

The interconnected EHD system should be an integral factor of the healthcare information system because it would connect different systems of electronic records in healthcare institutions into an information-organized image of the patient's treatment throughout the completely healthcare system. Patients are also intended to be consumers of the system by having control over entered data through active participation, by entering data and observations on their own condition. In brief, electronic record is a prerequisite for all future projects in e-health and changes in healthcare system financing.

Functional improvements of the implementation of electronic healthcare documentation are:

- better examination of medical records,
- extended software for particular physicians and gynecologist,
- all reporting requirements are duly met (statistical, clinical),
- monitoring of quality parameters, demographic statistics as an element of capitation,
- easier invoicing (for some functions automatic),
- improved management (examination appointment scheduling, team scheduling),
- search of electronic records under different criteria (orders, examinations, important events, status and results, sick leaves, immunizations etc.),
- availability of Visit Resume as a standard of accreditation, noting risk factors, warning of mandatory registering of contagious diseases,
- numerous technological improvements.

In the following three years, the Ministry of Health will develop an institutional frame that will enable undistracted and timely development of all subcomponents of the healthcare information system. This frame consists of the following [4]:

- creating the “Strategy of information systems in healthcare“ and an appropriate action plan by the end of 2008,
- bringing new legislative regulations in the domain of medical evidence by the end of 2009,
- ensuring Serbia becomes a member of the most important European associations for medical informatics during 2008 and 2009,
- creating medical informatics sectors in the Ministry of Health by the end of 2010 with following obligations:
 - To implement strategy and action plan,

Applying electronic documents in development of the healthcare information system in the Republic of Serbia

- To bring and control implementation of standards,
 - To plan and implement informatics projects in the healthcare system.
- The basic subprojects to be continued in the following period are:
- by 2010 to connect all healthcare institutions owned by the state (about 400) into a unique informational network that would be financed by the World Bank credit currently being approved,
 - continuous development of the information system of the Republic Department of Healthcare Insurance, by own means and to a lesser extent through credits,
 - further improvement of the central information system that would be financed by the World Bank credit currently being approved,
 - introduction of the information system into primary healthcare in all 161 health centers by the end of 2010,
 - introduction of an improved hospital information system into at least 19 hospitals during 2009 and 2010. EU IPA (Instrument for Pre-accession Assistance) funds necessary for 10 hospitals are being approved, as well as a credit from the World Bank which would finance further development or a whole new system in nine hospitals,
 - electronic healthcare records will continue to grow within the scope of local initiatives, and on the national level only when the funds for the above mentioned projects are obtained.

5. Discussion - critical review of the system

All partners in the system must give contributions in development of EHD. Advantages of using this system are:

- better medical documentations,
- increase efficiency of work in health institutions,
- electronic document management,
- increase standards of health care,
- data collections for better patients care,
- advanced statistical data analysis,
- better communication between partners in EHD.

This information system, which is better than manual data collection, has a weakness:

- education level of patients to use computers and communications services,
- lack of communications between physician and patients,
- unconcerned and raw physicians for EHD.

One of the partners is state fund of healthcare insurance. Fund can receive better and more precise information about health status of an each user. The basic idea is to make more effective and qualitative work for all participants in process of healthcare, with less cost. Disposal with right information enable preparing precise report about use of hospital capacity. Simultaneously, track

Marina Jovanović Milenković, Zoran Radojičić, Dejan Milenković, and Dragan Vukmirović

down of patients is more simplify in process of healing. This model is reversed to a patients and their health, wane of cost attempt on less number of adverse events. It is possible to recalculate premium and reduce cost for an each user, if insurance fund has right information.

In addition, information about medication is very important. Agency for medicaments and medical facilities of Serbia can provide more information about drugs quantity and structure on the market of Serbia, using database of EHD. System can produce database of needed drugs for each patients, especially for chronic diseases, and provide optimal circulation. Monthly reports about used drugs enable better prediction of needed drugs and medical facilities, reducing dispersal or deficit. Better management system with medications and medical facilities can reduce cost of the healthcare system rapidly [10].

Usage of electronic healthcare system in EU countries is different. An example, Danish physicians of primary care has wide broadband internet (91%), and 60% of clinics use e-mail as common way to communicate with patients. The average of using e-mail to communicate for all EU countries is 4%. In the other hand, at Romania only 5% of physicians have good and quality Internet connections [9].

6. Conclusion

This paper provides a survey of the development of the healthcare information system in the Republic of Serbia. The development strategy of an integrated e-health system is in accordance with the principles and standards of EU and is a part of the electronic healthcare system of the Republic of Serbia.

All participant in the system of healthcare (Ministry of health, government, fund of health insurances, insurance companies, health institutions and professional associations) need to collaborate about who will be a carrier and support it. Carrier must be an independent body specialized to made solutions in making and maintenance of the system. Controlling will be organized from specialized body consist form participants.

The main goal is to made universal and integrated e-health system, which can be technically provided to collect and manage with health, clinical and administrative financial informations.

In that meaning, health institutions and other subjects included in healthcare system must expand sense that e-health system is complex and multidisciplinary work. All participants in the system have to know basic elements of medicine and informatics, which can produce adequate results in applying e-health system in Republic of Serbia.

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Marina Jovanović Milenković born in Belgrade, Serbia, 1976. Now she is an Associate on PhD academic studies in the Faculty of Organizational Sciences at the Belgrade University. She finished postgraduate studies in the field of e-business in the Faculty of Organizational Sciences at the Belgrade University. Marina published papers in the areas of e-business, marketing and e-health.

Marina Jovanović Milenković, Zoran Radojičić, Dejan Milenković, and Dragan Vukmirović

Zoran Radojičić, born in Belgrade, Serbia, 1967. Finish Faculty of Organizational Sciences. Doctoral studies finished 2007. Now he is professor at Faculty teaching probability and statistics. His field of interest are statistics, biostatistics, e-business, internet, marketing...

Dejan Milenković born in Vranje, Serbia, 1976. Now he is an officer in the Administration for Telecommunications and Informatics of the General Staff of the Serbian Armed Forces. He finished postgraduate studies in the field of e-business in the Faculty of Organizational Sciences at the Belgrade University. Dejan published papers in the areas of e-business, content management system, electronic document management system.

Dragan Vukmirović born in Otočac, Croatia, 1962. He is an Associate Professor in the Faculty of Organizational Sciences at the Belgrade University and Director of the Statistical Office of the Republic of Serbia. Dragan published papers and participated in research projects in the areas of statistics, e-business and health. He was founder and coordinator of the master studies in e-business and the postgraduate studies on the Internet technology and e-business at the Faculty of Organizational Sciences.

Received: April 05, 2009; Accepted: October 26, 2009.